Was is claimed is:

1. An RF plasma generator comprising:

a) a variable frequency RF generator, comprising an H-bridge and an RF output, that generates electromagnetic radiation having a power;

b) a matching network comprising at least one variable impedance component, the matching network including a first port that is electromagnetically coupled to the output of the RF generator and a second port;

c) a load that is electromagnetically coupled to the second port of the matching network; and

d) a plasma chamber for containing a plasma having a power, the plasma chamber being electromagnetically coupled to the load, the plasma chamber receiving electromagnetic radiation having a power from the load, wherein

adjusting at least one of the frequency of the RF generator and the variable impedance component in the matching network changes the power in the plasma.

2. The RF plasma generator of claim 1 wherein the load is reactive.

3. The RF plasma generator of claim 1 wherein the matching network transforms the impedance of the reactive load to a substantially real impedance.

4. The RF plasma generator of claim 1 wherein the load comprises an inductive load.

5. The RF plasma generator of claim 1 wherein the load comprises a capacitive load.

6. The RF plasma generator of claim 1 wherein the adjusting the at least one of the frequency of the RF generator and the variable impedance component in the matching network substantially matches an impedance of the load to an output impedance of the RF generator.

7. The RF plasma generator of claim 1 wherein the adjusting the at least one of the frequency of the RF generator and the variable impedance component in the matching network increases the power in the plasma.

8. The RF plasma generator of claim 1 wherein the matching network has a substantially

resistive impedance at a frequency of the electromagnetic radiation.

9. The RF plasma generator of claim 1 wherein the matching network comprises a series combination of an amplifier and a variable capacitance capacitor.

10. The RF plasma generator of claim 9 wherein the variable capacitor is electrically controllable.

11. The RF plasma generator of claim 1 wherein the RF generator and the matching network are physically integrated in a device housing.

12. The RF plasma generator of claim 1 further comprising a sensor that measures power delivered to the load.

13. The RF plasma generator of claim 1 wherein the at least one of the frequency of the RF generator and the variable impedance component in the matching network is adjusted in response to a measurement of the sensor.

14. The RF plasma generator of claim 13 wherein the at least one of the frequency of the RF generator and the variable impedance component in the matching network is adjusted to minimize power reflected from the plasma.

15. The RF plasma generator of claim 13 wherein the at least one of the frequency of the RF generator and the variable impedance component in the matching network is adjusted to maximize power in the plasma.

16. The RF plasma generator of claim 1 wherein the plasma has a power that is related to the power of the electromagnetic radiation that is coupled from the load to the plasma.

17. The RF plasma generator of claim 1 wherein the matching network comprises switching transistors.

18. A method for stabilizing a plasma, the method comprising:

a) generating electromagnetic radiation with an RF generator that includes an H-bridge, the electromagnetic radiation having a power that is related to a DC voltage applied to an RF generator bus;

b) coupling the electromagnetic radiation to a plasma;

c) sensing the power in the electromagnetic radiation generated by the RF generator; and

d) adjusting the DC voltage applied to the RF generator bus in response to the sensed power so as to maintain a substantially constant power in the plasma.

19. The method of claim 18 wherein the sensing the power in the plasma comprises measuring a voltage and a current of the electromagnetic radiation.

20. The method of claim 18 wherein the power is maintained substantially constant with a time constant of less than 10kHz.

21. A method for stabilizing a plasma, the method comprising:

a) generating electromagnetic radiation with an RF generator that includes an H-bridge, the electromagnetic radiation having a power that is related to a DC voltage applied to an RF generator bus;

b) coupling the electromagnetic radiation to a plasma;

c) measuring an impedance of the load impedance; and

d) adjusting the DC voltage applied to the RF generator bus in response to the measured load impedance so as to maintain a substantially constant power in the plasma.

22. The method of claim 21 wherein the sensing the change in the load impedance comprises determining the rate of change of the power of the electromagnetic radiation with time.

23. A method for stabilizing a plasma, the method comprising:

a) generating electromagnetic radiation with an RF generator that includes an H-bridge, the electromagnetic radiation having a power that is related to a DC voltage applied to an RF generator bus;

b) coupling the electromagnetic radiation to a plasma;

c) sensing a power of the plasma; and

d) adjusting the DC voltage applied to the RF generator bus in response to the sensed power of the plasma so as to maintain a substantially constant power in the plasma.

24. The method of claim 23 wherein the sensing the power of the plasma comprises measuring optical radiation emitted by the plasma.

25. A method for stabilizing a plasma, the method comprising:

a) generating electromagnetic radiation with an RF generator that includes an H-bridge, the electromagnetic radiation having a power that is related to a DC voltage applied to an RF generator bus;

b) electromagnetically coupling the electromagnetic radiation to an impedance matching network;

c) sensing a power of the electromagnetic radiation propagating through the matching impedance;

d) coupling the electromagnetic radiation to a plasma; and

e) adjusting the DC voltage applied to the RF generator bus in response to the sensed power of the electromagnetic radiation propagating through the matching impedance so as to maintain a substantially constant power in the plasma.

26. A method for stabilizing a plasma, the method comprising:

a) generating electromagnetic radiation with an RF generator;

b) coupling the electromagnetic radiation to a plasma;

c) sensing a power related to the power in the plasma; and

d) adjusting an output impedance of the RF generator in response to the sensed power related to the power in the plasma to an impedance that maintains at least one plasma parameter at a substantially constant value.

27. The method of claim 26 wherein the power related to the power in the plasma comprises a power generated by the RF generator.

28. The method of claim 26 wherein the impedance that maintains a substantially constant power in the plasma comprises a predetermined impedance.

29. The method of claim 26 wherein the power is maintained substantially constant with a time constant of less than 10kHz.

30. An RF plasma generator comprising:

a) an RF generator, comprising an H-bridge and an RF output, that generates electromagnetic radiation at a frequency;

b) a matching network having an impedance that is substantially resistive at the frequency of the RF electromagnetic radiation, the matching network including a first port that is electromagnetically coupled to the output of the RF generator and a second port,

c) a load that is electromagnetically coupled to the second port of the matching network; and

d) a plasma chamber for containing a plasma therein, the plasma chamber being electromagnetically coupled to the load.

31. The RF plasma generator of claim 30 wherein the RF generator comprises a variable frequency RF generator.

32. An RF plasma generator comprising:

a) an RF generator including an RF output that generates electromagnetic radiation at a frequency;

b) a matching network comprising a 3-port solid state device that controls a change of a capacitance of a component in the matching network, an impedance of the matching network being substantially resistive at the frequency of the RF electromagnetic radiation, the matching network including a first port that is electromagnetically coupled to the output of the RF generator and a second port,

c) a load that is electromagnetically coupled to the second port of the matching network; and

d) a plasma chamber for containing a plasma therein, the plasma chamber being electromagnetically coupled to the load.

33. An RF plasma generator comprising:

a) an RF generator, comprising an H-bridge and an RF output, that generates electromagnetic radiation having a power;

b) a matching network comprising a series combination of an amplifier and a variable capacitance capacitor, the matching network including a first port that is

electromagnetically coupled to the output of the RF generator and a second port;

c) a load that is electromagnetically coupled to the second port of the matching network; and

d) a plasma chamber for containing a plasma having a power, the plasma chamber being electromagnetically coupled to the load, the plasma chamber receiving electromagnetic radiation having a power from the load, wherein

adjusting at least one of the frequency of the RF generator and the variable impedance component in the matching network changes the power in the plasma.

34. The RF plasma generator of claim 33 wherein the variable capacitance capacitor is electrically controllable.

35. An RF plasma generator comprising:

a) a variable frequency RF generator including an RF output that generates an RF signal having a power;

b) a matching network comprising at least one variable impedance component and a 3-port solid state device that controls a change of a capacitance of a component in the matching network, the matching network including a first port that receives the RF signal and a second port;

c) a load that is electrically coupled to the second port of the matching network; and

d) a plasma chamber for containing a plasma having a power, the plasma chamber being electromagnetically coupled to the load via the RF signal, wherein

adjusting at least one of the frequency of the RF generator and the variable impedance component in the matching network changes the power in the plasma.